



## **DEPARTMENT OF TRANSPORTATION**

### **Federal Aviation Administration**

#### **14 CFR Part 39**

**[Docket No. FAA-2023-0922; Project Identifier AD-2022-01431-T]**

**RIN 2120-AA64**

#### **Airworthiness Directives; The Boeing Company Airplanes**

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Notice of proposed rulemaking (NPRM).

**SUMMARY:** The FAA proposes to supersede Airworthiness Directive (AD) 2022-06-16, which applies to all The Boeing Company Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, and 747-400F series airplanes. AD 2022-06-16 requires revising the limitations and operating procedures sections of the existing airplane flight manual (AFM) to incorporate specific operating procedures for takeoff, instrument landing system (ILS) approaches, non-precision approaches, and go around and missed approaches, when in the presence of 5G C-Band interference as identified by Notices to Air Missions (NOTAMs). Since the FAA issued AD 2022-06-16, the FAA determined that additional limitations are needed due to the continued deployment of new 5G C-Band base stations whose signals are expected to cover most of the contiguous United States at transmission frequencies between 3.7-3.98 GHz. This proposed AD would require revising the limitations section of the existing AFM to incorporate limitations requiring specific operating procedures, and would retain the operating procedures for takeoff, ILS approaches, non-precision approaches, and go around and missed approaches from AD 2022-06-16, due to the presence of 5G C-Band interference. The FAA is proposing this AD to address the unsafe condition on these products.

**DATES:** The FAA must receive comments on this proposed AD by [INSERT DATE 20 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**ADDRESSES:** You may send comments, using the procedures found in 14 CFR 11.43 and 11.45, by any of the following methods:

- Federal eRulemaking Portal: Go to [regulations.gov](https://www.regulations.gov). Follow the instructions for submitting comments.
- Fax: 202-493-2251.
- Mail: U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue SE, Washington, DC 20590.
- Hand Delivery: Deliver to Mail address above between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

*AD Docket:* You may examine the AD docket at [regulations.gov](https://www.regulations.gov) under Docket No. FAA-2023-0922; or in person at Docket Operations between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this NPRM, any comments received, and other information. The street address for Docket Operations is listed above.

**FOR FURTHER INFORMATION CONTACT:** Brett Portwood, Continued Operational Safety Technical Advisor, COS Program Management Section, Operational Safety Branch, FAA, 3960 Paramount Boulevard, Lakewood, CA 90712-4137; phone: 817-222-5390; email: [operationalsafety@faa.gov](mailto:operationalsafety@faa.gov).

**SUPPLEMENTARY INFORMATION:**

**Comments Invited**

The FAA invites you to send any written relevant data, views, or arguments about this proposal. Send your comments to an address listed under ADDRESSES. Include “Docket No. FAA-2023-0922; Project Identifier AD-2022-01431-T” at the beginning of

your comments. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. The FAA will consider all comments received by the closing date and may amend the proposal because of those comments.

Except for Confidential Business Information (CBI) as described in the following paragraph, and other information as described in 14 CFR 11.35, the FAA will post all comments received, without change, to [regulations.gov](https://www.regulations.gov), including any personal information you provide. The agency will also post a report summarizing each substantive verbal contact received about this proposed AD.

### **Confidential Business Information**

CBI is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (FOIA) (5 U.S.C. 552), CBI is exempt from public disclosure. If your comments responsive to this NPRM contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to this NPRM, it is important that you clearly designate the submitted comments as CBI. Please mark each page of your submission containing CBI as “PROPIN.” The FAA will treat such marked submissions as confidential under the FOIA, and they will not be placed in the public docket of this NPRM. Submissions containing CBI should be sent to Brett Portwood, Continued Operational Safety Technical Advisor, COS Program Management Section, Operational Safety Branch, FAA, 3960 Paramount Boulevard, Lakewood, CA 90712-4137; phone: 817-222-5390; email: [operationalsafety@faa.gov](mailto:operationalsafety@faa.gov). Any commentary that the FAA receives that is not specifically designated as CBI will be placed in the public docket for this rulemaking.

## **Background**

The FAA issued AD 2021-23-12, Amendment 39-21810 (86 FR 69984, December 9, 2021) (AD 2021-23-12), for all transport and commuter category airplanes equipped with a radio altimeter. AD 2021-23-12 was prompted by a determination that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 3.7-3.98 GHz frequency band (5G C-Band). AD 2021-23-12 requires revising the limitations section of the existing AFM to incorporate limitations prohibiting certain operations requiring radio altimeter data when in the presence of 5G C-Band interference as identified by NOTAMs. The agency issued AD 2021-23-12 because radio altimeter anomalies that are undetected by the automation or pilot, particularly close to the ground (e.g., landing flare), could lead to loss of continued safe flight and landing.

The FAA subsequently identified an additional hazard presented by 5G C-Band interference on The Boeing Company Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, and 747-400F series airplanes and issued AD 2022-06-16, Amendment 39-21982 (87 FR 14780, March 16, 2022) (AD 2022-06-16). AD 2022-06-16 was prompted by a determination that, during takeoff, approach, landings, and go-arounds, as a result of 5G C-Band interference, certain airplane systems may not properly function, resulting in increased flightcrew workload while on approach with the flight director, autothrottle, or autopilot engaged. AD 2022-06-16 requires revising the limitations and operating procedures sections of the existing AFM to incorporate specific operating procedures for takeoff, ILS approaches, non-precision approaches, and go around and missed approaches, when in the presence of 5G C-Band interference as identified by Notices to Air Missions (NOTAMs). The agency issued AD 2022-06-16 to address 5G C-Band interference that could result in increased

flightcrew workload and could lead to reduced ability of the flightcrew to maintain safe flight and landing of the airplane.

### **Actions Since AD 2022-06-16 Was Issued**

Since issuing AD 2022-06-16, the FAA determined that additional limitations are needed due to the continued deployment of new 5G C-Band base stations whose signals are expected to cover most of the contiguous United States at transmission frequencies between 3.7-3.98 GHz. Therefore, the FAA issued an NPRM, Docket No. FAA-2022-1647 (88 FR 1520, January 11, 2023) (the NPRM), proposing to supersede AD 2021-23-12. In the NPRM, the FAA proposed to retain most of the operational prohibitions required by AD 2021-23-12 until June 30, 2023; on or before June 30, 2023, operators would be required to revise their existing AFM to prohibit these operations unless the airplane has a radio altimeter meeting proposed minimum performance levels (a defined power spectral density (PSD) curve as well as a defined aggregate spurious emission level) and is operating at a 5G C-Band mitigated airport (5G CMA). In the NPRM, the FAA also proposed to require all airplanes operating under 14 CFR part 121 to have a radio altimeter meeting the proposed minimum performance standards by February 1, 2024.

Since the NPRM was published, the FAA has determined that a PSD curve is a more appropriate method to define performance than a single fixed emission level. The proposed PSD curve more accurately reflects differences in radio altimeter susceptibility to interfering emissions at different altitude levels. The FAA plans to issue guidance on how to show compliance with both the fundamental PSD curve and spurious PSD curve, including the data to be submitted, for the FAA to approve the method used.

AD 2022-06-16 relies on the FAA's use of NOTAMs to identify 5G C-band interference at certain airports in the U.S. airspace. As explained in more detail in the NPRM, those NOTAMs are no longer the best means of communicating the location of

the 5G C-Band environment. Therefore, this proposed AD would retain the AFM limitations required by AD 2022-06-16 until June 30, 2023. On or before June 30, 2023, this proposed AD would require operators to replace the limitations with limitations prohibiting the same operations, except the prohibitions would not be tied to NOTAMs but instead would depend on whether the airplane is operated at a 5G CMA as identified by an FAA Domestic Notice. Because the 5G C-Band Interference operating procedure required by AD 2022-06-16 does not reference NOTAMs, this proposed AD would retain that operating procedure requirement with no change.

### **FAA's Determination**

The FAA is issuing this NPRM after determining that the unsafe condition described previously is likely to exist or develop on other products of the same type design.

### **Proposed AD Requirements in this NPRM**

This proposed AD would retain the AFM revisions required by AD 2022-06-16, until June 30, 2023. On or before June 30, 2023, this proposed AD would require replacing those AFM revisions with limitations requiring the same procedures for dispatch or release to airports, and takeoff, approach, landing, and go-around on runways at all airports for non-radio altimeter tolerant airplanes. For radio altimeter tolerant airplanes, the procedures would not be required at 5G CMAs as identified in an FAA Domestic Notice. The minimum performance levels in this proposed AD for determining whether an airplane is radio altimeter tolerant are the same minimum performance levels proposed in the NPRM, except the FAA has replaced the proposed fixed emission level with a proposed PSD curve emission threshold that more accurately reflects differences in radio altimeter susceptibility to interfering emissions at different altitude levels.

Paragraph (k)(3) of this proposed AD specifies that AMOCs approved for AD 2021-23-12 providing relief for specific radio altimeter installations would be

approved as AMOCs for the requirements specified in paragraph (h) of this proposed AD until June 30, 2023. After June 30, 2023, operators with AMOCs approved for AD 2021-23-12 would be required to incorporate the 5G C-Band Interference operating procedure specified in paragraph (h)(2) of this proposed AD. The new AFM limitations, which would be required by paragraph (i) or (j) of this proposed AD, specify that operators must comply with this 5G C-Band Interference operating procedure.

### **Interim Action**

The FAA considers that this AD, if adopted as proposed, would be an interim action. Once the Technical Standard Order (TSO) standard for radio altimeters is established, which will follow the existing international technical consensus on the establishment of the minimum operational performance standards (MOPS), the FAA anticipates that the MOPS will be incorporated into the TSO. The FAA also anticipates that aircraft incorporating equipment approved under the new Radio Altimeter TSO will be able to operate in both 5G CMAs and non-5G CMAs with no 5G C-Band-related AFM limitations. Once a new radio altimeter TSO is developed, approved, and available, the FAA might consider additional rulemaking.

### **Costs of Compliance**

The cost information below describes the costs to change the AFM. Although this proposed AD would largely maintain the AFM limitations currently required by AD 2022-06-16, the FAA acknowledges that this proposed AD may also impose costs on some aircraft operators from having to change their conduct to comply with the amended AFM. However, the FAA lacks the data necessary to quantify the costs associated with aircraft operators changing their conduct. The FAA is seeking public comment on these costs so the agency can more fully account for the impact of this regulatory action.

The FAA estimates that this AD, if adopted as proposed, would affect 137 airplanes of U.S. registry.<sup>1</sup> The FAA estimates the following costs to comply with this proposed AD:

#### Estimated costs

Action	Labor cost	Parts cost	Cost per product	Cost on U.S. operators
AFM revision (retained actions from AD 2022-02-16)	1 work-hour X \$85 per hour <sup>2</sup> = \$85	\$0	\$85	\$11,645
New AFM revisions (new proposed action)	1 work-hour X \$85 per hour = \$85	\$0	\$85	\$11,645 <sup>3</sup>

#### Authority for this Rulemaking

Title 49 of the United States Code specifies the FAA’s authority to issue rules on aviation safety. Subtitle I, section 106, describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the Agency’s authority.

The FAA is issuing this rulemaking under the authority described in Subtitle VII, Part A, Subpart III, Section 44701: General requirements. Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority because it addresses an unsafe condition that is likely to exist or develop on products identified in this rulemaking action.

<sup>1</sup> This is the number of Boeing Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, and 747-400F series airplanes on the FAA’s registry as of December 1, 2022.

<sup>2</sup> The labor rate of \$85 per hour is the average wage rate for an aviation mechanic.

<sup>3</sup> The estimated cost for this revision would not constitute a significant economic impact (even for small entities) because \$85 is a minimal cost compared to the regular costs of maintaining and operating a Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, or 747-400F transport category airplane.



## **Regulatory Findings**

The FAA has determined that this proposed AD would not have federalism implications under Executive Order 13132. This proposed AD would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government.

For the reasons discussed above, I certify that the proposed regulation:

- (1) Is not a “significant regulatory action” under Executive Order 12866,
- (2) Would not affect intrastate aviation in Alaska, and
- (3) Would not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

## **List of Subjects in 14 CFR Part 39**

Air transportation, Aircraft, Aviation safety, Incorporation by reference, Safety.

## **The Proposed Amendment**

Accordingly, under the authority delegated to me by the Administrator, the FAA proposes to amend 14 CFR part 39 as follows:

### **PART 39 - AIRWORTHINESS DIRECTIVES**

- 1. The authority citation for part 39 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

#### **§ 39.13 [Amended]**

- 2. The FAA amends § 39.13 by:

- a. Removing Airworthiness Directive (AD) 2022-06-16, Amendment 39-21982 (87 FR 14780, March 16, 2022), and

- b. Adding the following new AD:

**The Boeing Company Airplanes:** Docket No. FAA-2023-0922; Project Identifier AD-2022-01431-T.

**(a) Comments Due Date**

The FAA must receive comments on this airworthiness directive (AD) by [INSERT DATE 20 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**(b) Affected ADs**

This AD replaces AD 2022-06-16, Amendment 39-21982 (87 FR 14780, March 16, 2022) (AD 2022-06-16).

**(c) Applicability**

This AD applies to all The Boeing Company Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, and 747-400F series airplanes, certificated in any category.

**(d) Subject**

Air Transport Association (ATA) of America Code 34, Navigation.

**(e) Unsafe Condition**

This AD was prompted by a determination that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 3.7-3.98 GHz frequency band (5G C-Band), and a determination that during takeoff, approach, landings, and go-arounds, as a result of this interference, certain airplane systems may not properly function, resulting in increased flightcrew workload while on approach with the flight director, autothrottle, or autopilot engaged. The FAA is issuing this AD to address 5G C-Band interference that could result in increased flightcrew workload and could lead to reduced ability of the flightcrew to maintain safe flight and landing of the airplane.

**(f) Compliance**

Comply with this AD within the compliance times specified, unless already done.

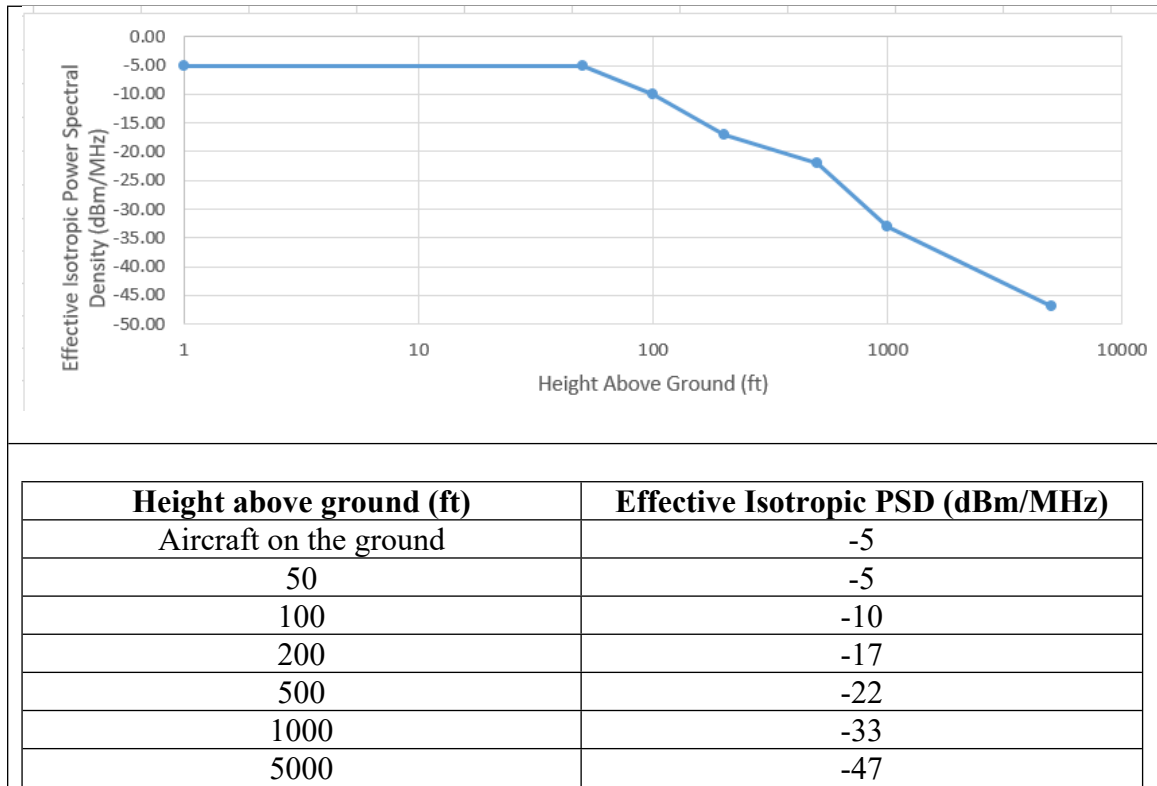
**(g) Definitions**

(1) For purposes of this AD, a “5G C-Band mitigated airport” (5G CMA) is an airport at which the telecommunications companies have agreed to voluntarily limit their 5G deployment at the request of the FAA, as identified by an FAA Domestic Notice.

(2) For purposes of this AD, a “radio altimeter tolerant airplane” is one for which the radio altimeter, as installed, demonstrates the tolerances specified in paragraphs (g)(2)(i) and (ii) of this AD, using a method approved by the FAA.

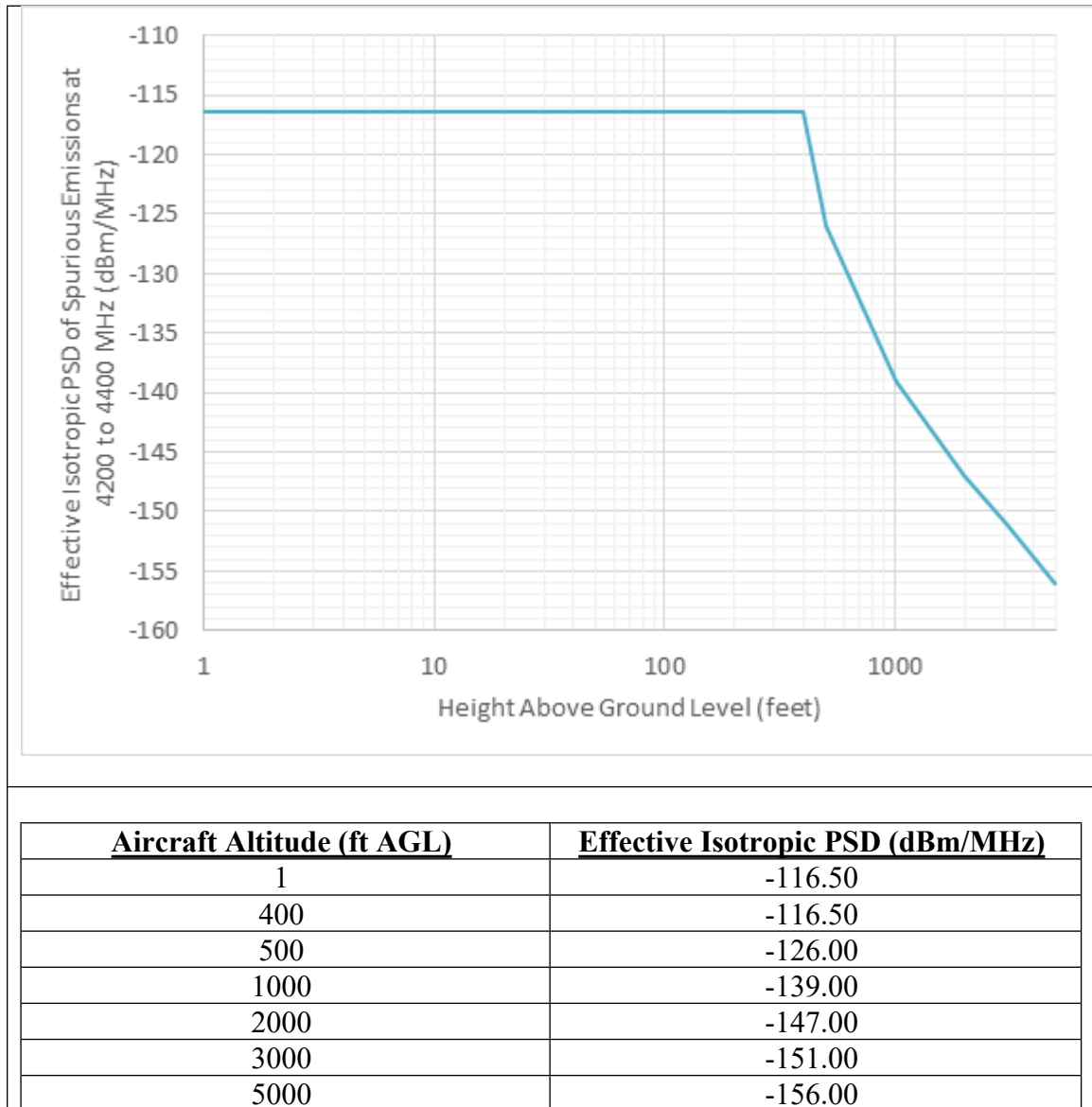
(i) Tolerance to radio altimeter interference, for the fundamental emissions (3.7-3.98 GHz), at or above the power spectral density (PSD) curve threshold specified in figure 1 to paragraph (g)(2)(i) of this AD.

**Figure 1 to paragraph (g)(2)(i) – *Fundamental Effective Isotropic PSD at Outside Interface of Aircraft Antenna***



(ii) Tolerance to radio altimeter interference, for the spurious emissions (4.2-4.4 GHz), at or above the PSD curve threshold specified in figure 2 to paragraph (g)(2)(ii) of this AD.

**Figure 2 to paragraph (g)(2)(ii) – Spurious Effective Isotropic PSD at Outside Interface of Aircraft Antenna**



(3) For purposes of this AD, a “non-radio altimeter tolerant airplane” is one for which the radio altimeter, as installed, does not demonstrate the tolerances specified in paragraphs (g)(2)(i) and (ii) of this AD.

**(h) Retained Airplane Flight Manual (AFM) Revision**

This paragraph restates the requirements of paragraph (h) of AD 2022-02-16.

(1) Within 2 days after March 16, 2022 (the effective date of AD 2022-06-16):

Revise the Limitations Section of the existing AFM to include the information specified

in figure 3 to paragraph (h)(1) of this AD. This may be done by inserting a copy of figure 3 to paragraph (h)(1) of this AD into the existing AFM.

**Figure 3 to paragraph (h)(1) – AFM Limitations Revision**

**(Required by AD 2022-06-16)**

**Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around**

The following limitations are required for dispatch or release to airports, and takeoff, approach, landing, and go-around on runways, in U.S. airspace in the presence of 5G C-Band wireless broadband interference as identified by NOTAM (NOTAMs will be issued to state the specific airports or approaches where the radio altimeter is unreliable due to the presence of 5G C-Band wireless broadband interference).

**Takeoff, Approach, Landing, and Go-Around**

Operators must use the Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around procedure contained in the Operating Procedures section of this AFM.

(2) Within 2 days after March 16, 2022 (the effective date of AD 2022-06-16):

Revise the Operating Procedures Section of the existing AFM to include the information specified in figure 4 to paragraph (h)(2) of this AD. This may be done by inserting a copy of figure 4 to paragraph (h)(2) of this AD into the existing AFM.

(Required by AD 2022-06-16)

**Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around**

**Takeoff**

If autopilot does not engage above the minimum altitude, when at a safe altitude, select both flight director switches OFF, then ON, to re-engage. LNAV and VNAV may not engage or engage at an erroneous altitude after departure.

**ILS Approaches**

For ILS approaches, disconnect the autopilot and autothrottle, and place both flight director switches to OFF prior to glideslope intercept. Do not set RADIO minimums on the EFIS control panel, use BARO minimums only.

**Non-Precision Approaches**

Autopilot, autothrottles, and flight directors may be used. Do not use autothrottles if the autopilot is disengaged. Prior to descending below MDA, disconnect the autothrottle and disengage the autopilot.

**Landing**

Do not rely on radio altimeter-based altitude aural callouts during approach. Adjust operational (time of arrival) landing distance for manual speedbrake deployment.

**During Go-Around and Missed Approach**

If go-around is required, ensure thrust is increased to go-around power.

When the flight director switches are OFF, push either TO/GA switch to display the flight director bars. When able, turn both flight directors to ON.

TO/GA mode may not be available. Autopilot may not be available. Monitor pitch and roll modes for engagement.

**(i) New Requirement: AFM Revision for Non-Radio Altimeter Tolerant Airplanes**

For non-radio altimeter tolerant airplanes, do the actions specified in paragraphs (i)(1) and (2) of this AD.

(1) On or before June 30, 2023, revise the Limitations Section of the existing AFM to include the information specified in figure 5 to paragraph (i) of this AD. This may be done by inserting a copy of figure 5 to paragraph (i) of this AD into the existing AFM. Incorporating the AFM revision required by this paragraph terminates the AFM revision required by paragraph (h)(1) of this AD.

(2) Before further flight after incorporating the limitations specified in figure 5 to paragraph (i) of this AD, remove the AFM revision required by paragraph (h)(1) of this AD.

**Figure 5 to paragraph (i) – AFM Revision for Non-Radio Altimeter Tolerant Airplanes**

**(Required by AD 20\*\*-\*\*-\*\*)**

**Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around**

Due to the presence of 5G C-Band wireless broadband interference, the following limitations are required for dispatch or release to airports, and takeoff, approach, landing, and go-around on runways, in the contiguous U.S. airspace.

**Takeoff, Approach, Landing, and Go-Around**

Operators must use the Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around procedure contained in the Operating Procedures section of this AFM.

**(j) New Requirement: AFM Revision for Radio Altimeter Tolerant Airplanes**

For radio altimeter tolerant airplanes, do the actions specified in paragraphs (j)(1) and (2) of this AD.

(1) On or before June 30, 2023, revise the Limitations Section of the existing AFM to include the information specified in figure 6 to paragraph (j) of this AD. This may be done by inserting a copy of figure 6 to paragraph (j) of this AD into the existing AFM. Incorporating the AFM revision required by this paragraph terminates the AFM revision required by paragraph (h)(1) of this AD.

(2) Before further flight after incorporating the limitations specified in figure 6 to paragraph (j) of this AD, remove the AFM revision required by paragraph (h)(1) of this AD.



**Figure 6 to paragraph (j) – AFM Revision for Radio Altimeter Tolerant Airplanes**

**(Required by AD 20\*\*-\*\*-\*\*)**

**Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around**

Due to the presence of 5G C-Band wireless broadband interference, the following limitations are required for dispatch or release to airports, and takeoff, approach, landing, and go-around on runways, in the contiguous U.S. airspace unless operating at a 5G C-Band mitigated airport as identified in an FAA *Domestic Notice*.

**Takeoff, Approach, Landing, and Go-Around**

Operators must use the Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around procedure contained in the Operating Procedures section of this AFM.

**(k) Alternative Methods of Compliance (AMOCs)**

(1) The Manager, Operational Safety Branch, FAA, has the authority to approve AMOCs for this AD, if requested using the procedures found in 14 CFR 39.19. In accordance with 14 CFR 39.19, send your request to your principal inspector or responsible Flight Standards Office, as appropriate. If sending information directly to the manager of the Operational Safety Branch, send it to the attention of the person identified in paragraph (m) of this AD. Information may be emailed to: [AMOC@faa.gov](mailto:AMOC@faa.gov).

(2) Before using any approved AMOC, notify your appropriate principal inspector, or lacking a principal inspector, the manager of the responsible Flight Standards Office.

(3) AMOCs approved for AD 2021-23-12, Amendment 39-21810 (86 FR 69984, December 9, 2021) providing relief for specific radio altimeter installations are approved as AMOCs for the requirements specified in paragraph (h) of this AD until June 30, 2023.

**(l) Related Information**

For more information about this AD, contact Brett Portwood, Continued Operational Safety Technical Advisor, COS Program Management Section, Operational

Safety Branch, FAA, 3960 Paramount Boulevard, Lakewood, CA 90712-4137; phone: 817-222-5390; email: [operationalsafety@faa.gov](mailto:operationalsafety@faa.gov).

**(m) Material Incorporated by Reference**

None.

Issued on April 28, 2023.

Michael Linegang, Acting Director,  
Compliance & Airworthiness Division,  
Aircraft Certification Service.

[FR Doc. 2023-09430 Filed: 5/1/2023 4:15 pm; Publication Date: 5/3/2023]